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INVESTIGATION OF HIGH WATER TABLE
TOWNSHIP OF FLAMBOROUGH
REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH



Ministry
of the
Environment

The Honourable
Harry C. Parrott, D.D.S.,
Minister
Graham W. Scott,
Deputy Minister

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ONTARIO MINISTRY OF THE ENVIRONMENT
WEST CENTRAL REGION
TECHNICAL SUPPORT SECTION

INVESTIGATION OF HIGH WATER TABLE

TOWNSHIP OF FLAMBOROUGH

REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

The Effect of the Valens Reservoir
on Overburden and Bedrock Hydrology

of the Valens Area

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SUMMARY

The Valens Reservoir is located on a bedrock outcrop, and is hydraulically connected to the bedrock aquifer by fractures, solution channels, and also an abandoned, unplugged, drilled well which is now under the water impounded in the reservoir. The increased water pressure on the aquifer due to the reservoir has caused some drilled wells in the immediate Valens area, to flow perennially or intermittently depending on water level elevations in the reservoir. The water quality of the bedrock aquifer may now also be influenced by the reservoir water quality.

In addition, due to the surficial geology of the area and newly created flow gradients since dam construction, the elevation of the water table has increased. The natural ground water hydrology of the area has been modified to the extent that drainage basin boundaries may have been altered since the study area is situated near the Lake Ontario-Lake Erie Drainage Basin divide.

As a result, the effects of the Valens reservoir have raised allegations of perennial wetland or swamp since the reservoir construction.

INTRODUCTION:

In response to the February 28th, 1977 letter from Mr. Keith Marcy, owner and operator of a farm in the Community of Valens, a study was initiated May 12th, 1977 to determine the effect of the Valens Reservoir on the water table in the vicinity of the Marcy farm.

The scope of study included examination of water well records, water well level surveys, area resident interviews, levelling surveys, and examination of previous reports addressed to the wetland problem.

Mr. R. G. Pearson, Head, Plant Protection Unit, Ministry of the Environment, was contacted to possibly obtain an expert opinion concerning the effect or alteration, if any, on the vegetation. Mr. Pearson will be submitting an independent report of his findings to Mr. Marcy.

LOCATION:

Mr. Marcy's farm is situated in Lot 24, Concession 8, Township of Flamborough on the opposite side of Highway 97 from the Valens Dam (Figure 1).

BACKGROUND:

According to the Hamilton Region Conservation Authority, water was first impounded in the Valens Reservoir during the spring of 1966. The recreational water level elevation would be 903.0 feet.

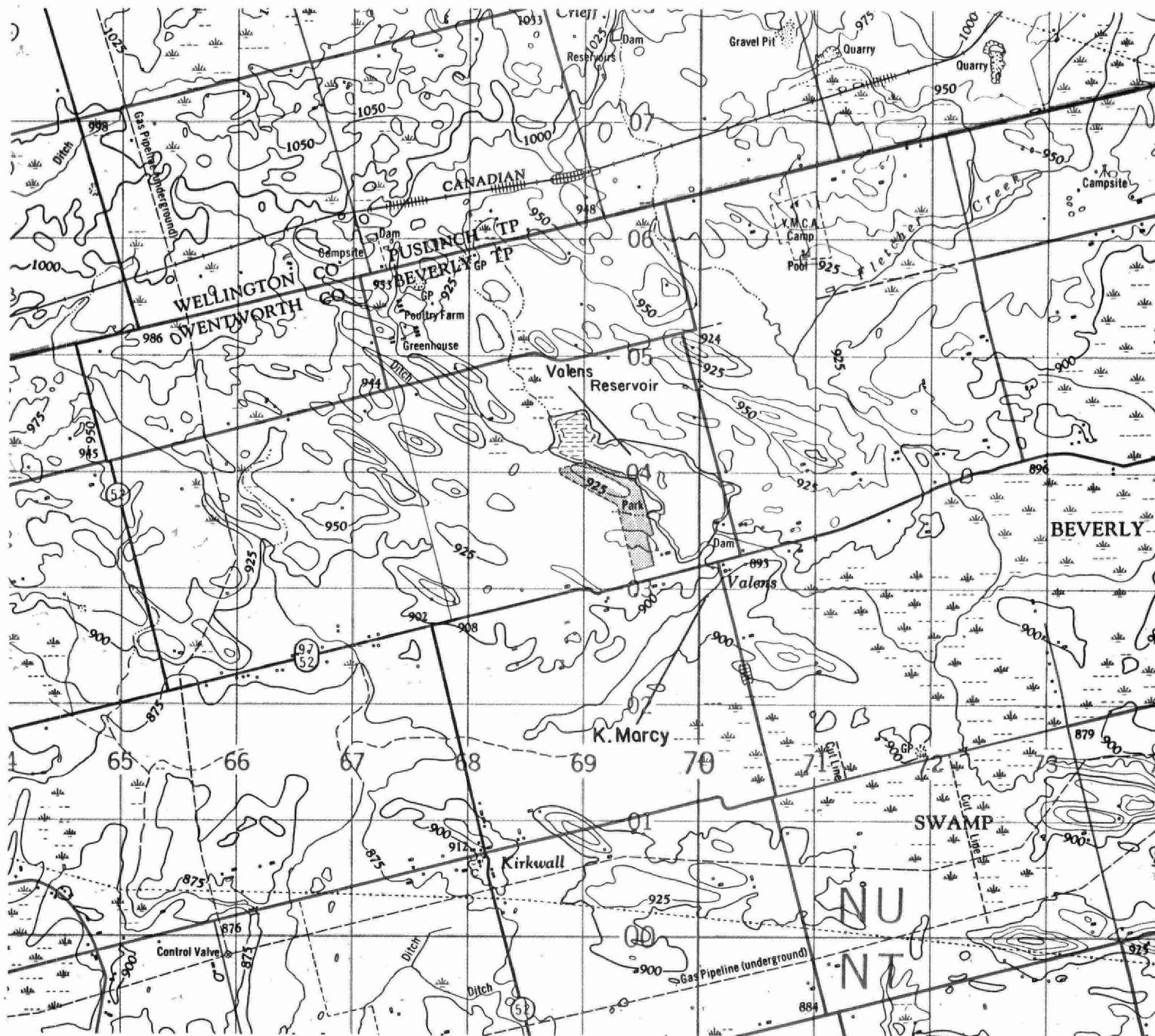


FIGURE I
Location Map

Mr. Marcy's complaint outlines his allegations of wetland caused by this impoundment. Mr. Marcy and his father advised that the portion of their farm in question has historically been wet, usually until late spring. The wetland was also documented by air photo interpretations included in the report of June 30th, 1976, by Professor R. W. Irwin, P.Eng. of the University of Guelph. However, according to Mr. Marcy the wetland which existed prior to the reservoir could still be cultivated and planted somewhat later than other parts of the farm. Mr. Marcy explains that the area now is perennially saturated with water, springs flow from the area continuously, and there is a considerable area of standing water throughout the year. Mr. Marcy stated that the area in his field has been transformed into a "swamp".

An attempt was made to increase the water flow away from this area into a culvert under Valens side road by bulldozing a wider ditch to drain the water away. Unfortunately, this has not improved the situation since water is still ponded year round.

Further relevant background information to the Marcy complaint is provided by the Dave Braden (Nick Law former owner) and Hamilton Region Conservation Authority case. As we are aware, a similar situation to Marcy's has occurred on the Braden property adjoining Highway 97 (see Figure 4). Since the impoundment of water in the Valen's Reservoir, Mr. Braden and Mr. Law have claimed that the property adjacent to Highway 97 has been transformed into a swampy, water-saturated wetland which was also once cultivated and cropped prior to the reservoir. John Coates of the Hamilton Region Conservation Authority advised that a report had been prepared by the Department of Energy and Resources Management in 1969 with regard to the Braden/Law property, and correlates reservoir water level changes with water table level variations by installation and observation of piezometers on the Braden/Law property.

GENERAL HYDROGEOLOGY:

The Pleistocene geology map No. 2029 of the Galt area (P. F. Karrow, 1961, Figure 2) indicates that the reservoir is situated on a shale and dolomite outcrop of Ordovician and Silurian age. The Marcy farm, along with most other farms in the immediate Valens area is located on the southern portion of the Moffat Moraine. The Moraine is comprised largely of Wentworth till varying from fine to coarse sandy till; the coarser textures containing cobbles and boulders. The bedrock surface in the area slopes generally from north to south reaching elevations of 950 feet in the vicinity of Highway 401 (five miles north of the study area) and approximately 700 feet (nine miles south of the study area) at Highway 5. The area of Spencer Creek, presently covered by the reservoir was likely a discharge area prior to the impoundment of water by the Valens Dam. Now, the impoundment acts partly as a recharge zone and provides for an increased hydraulic gradient to areas of lower elevation surrounding the reservoir.

The Wentworth till material in the Moffat Moraine is a relatively permeable material, permitting ground water recharge and movement. This would be controlled by the hydraulic gradient established with respect to the aquifer properties and surrounding topography of the area.



NATURAL DRAINAGE CHARACTERISTICS:

From the map Drainage Basins in Southern Ontario (Map 3002-2, Figure 3), it is evident that the study area is situated on the Lake Ontario and Grand River-Lake Erie Drainage Basin divide. Overburden and surface water drainage, according to the natural physiographic characteristics and the drainage basin map, seem to be toward Spencer Creek (Figure 3). The reservoir at this physiographically strategic location, may have altered directions of water flow from the natural hydrologic ground water/surface water conditions.

INVESTIGATIONS:

On June 21st, 1977 Mr. John Coates of the H.R.C.A. was contacted concerning the Marcy complaint. Mr. Coates was cooperative in arranging for a copy of a Department of Energy and Resources Management Report of 1969, to be forwarded to our office for evaluation in conjunction with the Marcy complaint.

Mr. Coates also forwarded information concerning the existence of an old drilled well located in the middle of the reservoir. He advised that the well was abandoned, unplugged, and now under water.

Field investigations included interviews with numerous area residents. People from the Valens Community, knowledgeable of local farmland conditions, well levels, etc., were sought to obtain statements of observations concerning conditions prior to and after the impoundment of water by the Valens Dam. The following are the statements of interviewed residents (locations Figure 4).



FIGURE 3
Drainage Basin Map

Scale

1:500,000

Mr. D. Harbottle - May 12th, 1977

Mr. Harbottle has resided in Lot 25, Concession 9 prior to the reservoir construction. The well in use is a large diameter, old, stone lined, dug well. Mr. Harbottle advised that he had experienced no serious problems with his well either before or after the reservoir, and stated merely that he observed the water level in his well fluctuating with the lowering and raising of the reservoir water level.

Mr. J. Stephens - May 12th, 1977

Mr. Stephens of Lot 25, Concession 8 was contacted May 12th, 1977. He indicated that his well was constructed in March 1966, and also added that the vent pipe approximately one foot above land surface from his well head, flows intermittently depending on the height of water in the reservoir. The well record indicates the well was flowing at the time of construction, and that it is drilled to 54 feet in depth, finished in the bedrock.

Mr. Stephens stated that the ditch, around his property and originating in the Marcy field, was constructed or cleaned out to facilitate drainage from the Marcy wetland down the ditch towards Spencer Creek. He mentioned that the ditch contains flowing water all year round and that the adjacent field owned by R. S. Coburn has been too wet to crop since the reservoir impoundment.

Mr. H. J. Mount - May 12th, 1977

Mr. Mount was encountered in the process of working his fields on Lot 23 and 24, Concession 8. It was obvious that the field being worked was one of the later fields to be cultivated since it was relatively low and wet. Mr. Mount did not observe any increased wetness in his fields and advised that this part of the farm had historically been more water saturated than others, thus necessitating later cultivation and cropping.

Mr. Mount has an old dug, stone lined well that was abandoned as a water supply, adjacent to his field laneway. He stated that after the impoundment of water by the Valens Dam, his dug well began flowing continuously whereas prior to the reservoir the well ceased flowing during the summer months.

Mr. D. Braden - June 3rd, 1977

Mr. Braden is the present owner of the N. Law Farm on Lot 25, Concession 9. He advised that the front part of his farm had been converted to a "swamp" since water impoundment, resulting in very minimal or no agricultural production.

At the time of the interview Mr. Braden mentioned that a report had been completed correlating reservoir water levels with piezometer water levels on his affected property. This report by the Department of Energy and Resources Management 1969 was subsequently confirmed by Mr. John Coates of the H.R.C.A., and provided for our review.

Mr. R. S. Coburn - June 3rd, 1977

Mr. Coburn has a farm situated in Lot 25, Concession 8 adjacent to the J. Stephen's property. A drilled well was constructed for Mr. Coburn in November 1971. The well record indicates the well is completed approximately three feet into the bedrock with a static water level of five feet at the time of construction. Mr. Coburn advised that in the spring of 1972, during rise of the reservoir water level to recreational height, the well began to flow. The well head is located approximately three feet below land surface, three feet above the basement floor and approximately two feet outside the basement wall. Mr. Coburn stated that the flowing well flooded his basement and may have caused structural damage to the foundations of his home. The well was observed flowing June 3rd, 1977 at the time of the interview. The well did not flow at the time of the construction in the fall of 1971 due to lower water levels since the reservoir was not at recreational level.

Mr. Coburn pointed out where silty material had oozed through the foundation of his home. Mr. Coburn showed the furnace area of the basement floor which was covered with a layer of silty mud. The remaining floor area was also muddy or covered with standing water. At the time of the investigation, the overflow from the well was observed flowing into the basement of the home.

Mr. Coburn also has a dug well on this property. The static level was measured to be nine feet below land surface on June 28th, 1977. This well is at a somewhat higher elevation than the drilled well.

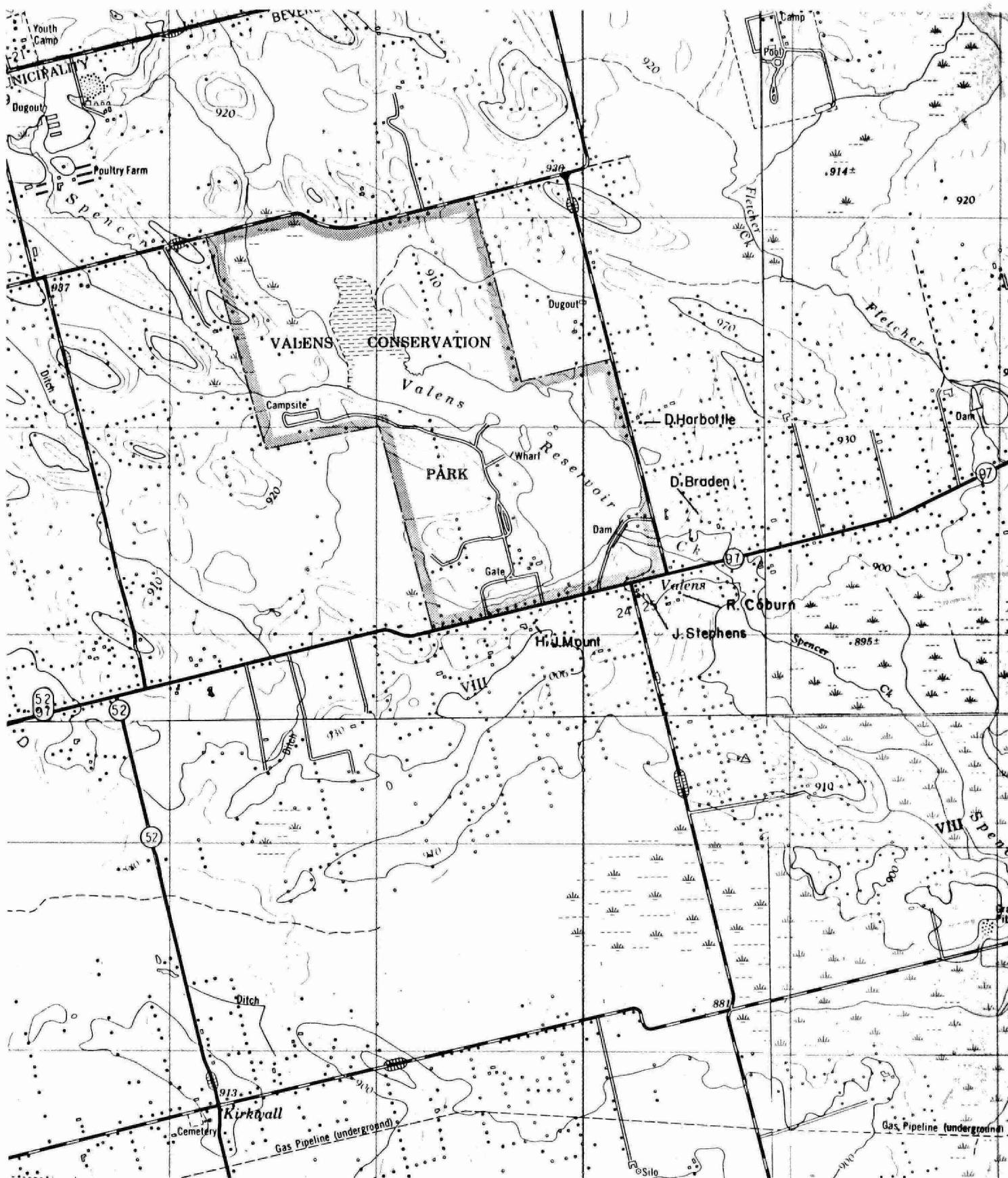


FIGURE 4
Interviewed Resident Location Map

Scale
1:25,000

Mr. Russel Wise - June 3rd, 1977

Mr. Wise was encountered on June 3rd, 1977 while interviewing Mr. Marcy on the Marcy farm. Mr. Wise resides on Lot 33, Concession 10 of Flamborough Township and is a former employee of the Hamilton Region Conservation Authority. Mr. Wise related that since he was born in this area, he is very well acquainted with farms in the Valens locality. He stated very emphatically that from his observations the reservoir had caused wetlands and "swamps" on parts of farms that prior to the dam, were actively cultivated. He offered to provide statements to this effect to anyone so concerned.

OBSERVATIONS:

The Valens study area was visited on several occasions during which time resident interviews and observations were made. The resident interviews and statements may have already outlined many observations, however, some additional inspections are noteworthy and others that may have been partially dealt with, will be elaborated further.

The old school house drilled well on the corner of Highway 97 and Valens side road, was flowing during all our inspections of the study area (Figure 5). Residents will again corroborate that this well began flowing unceasingly since the impoundment of water by the dam. On June 3rd, the Coburn well was also observed flowing. This is a bedrock well and information from the water well record is summarized in the Appendix. Mr. H. J. Mount's old, abandoned dug well was observed flowing during inspections on May 12th, 1977 and also June 16th, 1977 when the elevation of the water level was measured with respect to the elevation of the water in the reservoir. Similarly, the Marcy farm was visited on different occasions, June 3rd, 10th, 16th, 28th, 1977. At all times, the spring in the wetland area was flowing and standing water was noted.

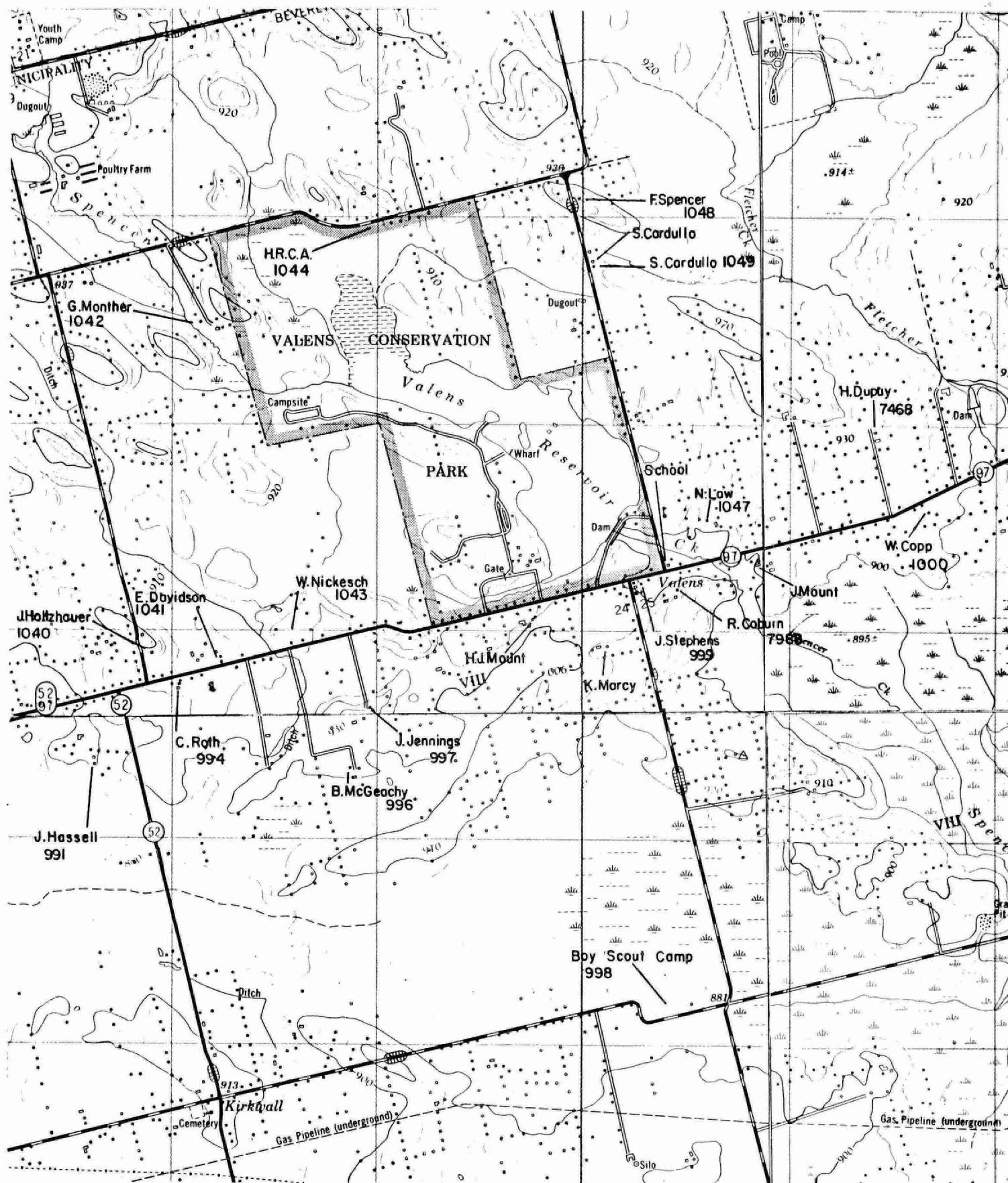


FIGURE 5
Well Water Level Survey Location Map

Scale
1:25,000

Two hydrogeologic cross sections (back pocket, location shown on Figures 7 and 8, Section A-A', B-B') along Valens Side Road and Highway 97 were prepared incorporating information from water well records, levelling, and water level surveys (well records summarized in Appendix). The cross sections show the extent of the Moffat Moraine and the location of the Marcy and Braden/Law farms on the Morainic deposit. A good correlation of the topography and elevation differentials, with respect to the location and water levels of wells and the elevation of the water level in the reservoir, is also obtained. Water table elevations, prior to the reservoir were supplied by the H.R.C.A. from pre-construction bore hole records. These are plotted indicating elevation differentials with respect to the present reservoir water level.

WATER LEVEL SURVEY:

An examination of water well records on file for the Valens area was conducted. In preparation for the water well level survey, records of wells drilled prior to the reservoir were selected to obtain static water levels prior to any effect the reservoir may have exerted. Of these, all accessible wells were then measured to obtain current static water levels (Figure 5). Thus, a comparison of ground water levels from before and after reservoir construction was possible (Table I).

LEVELLING SURVEY:

In order to establish elevation relationships between the reservoir water level, Mr. Marcy's wetland, and other wells in the area, a levelling survey was performed (Figure 6, Locations). All elevation measurements were taken relative to the concrete spillway elevation of the Valens Dam. Mr.

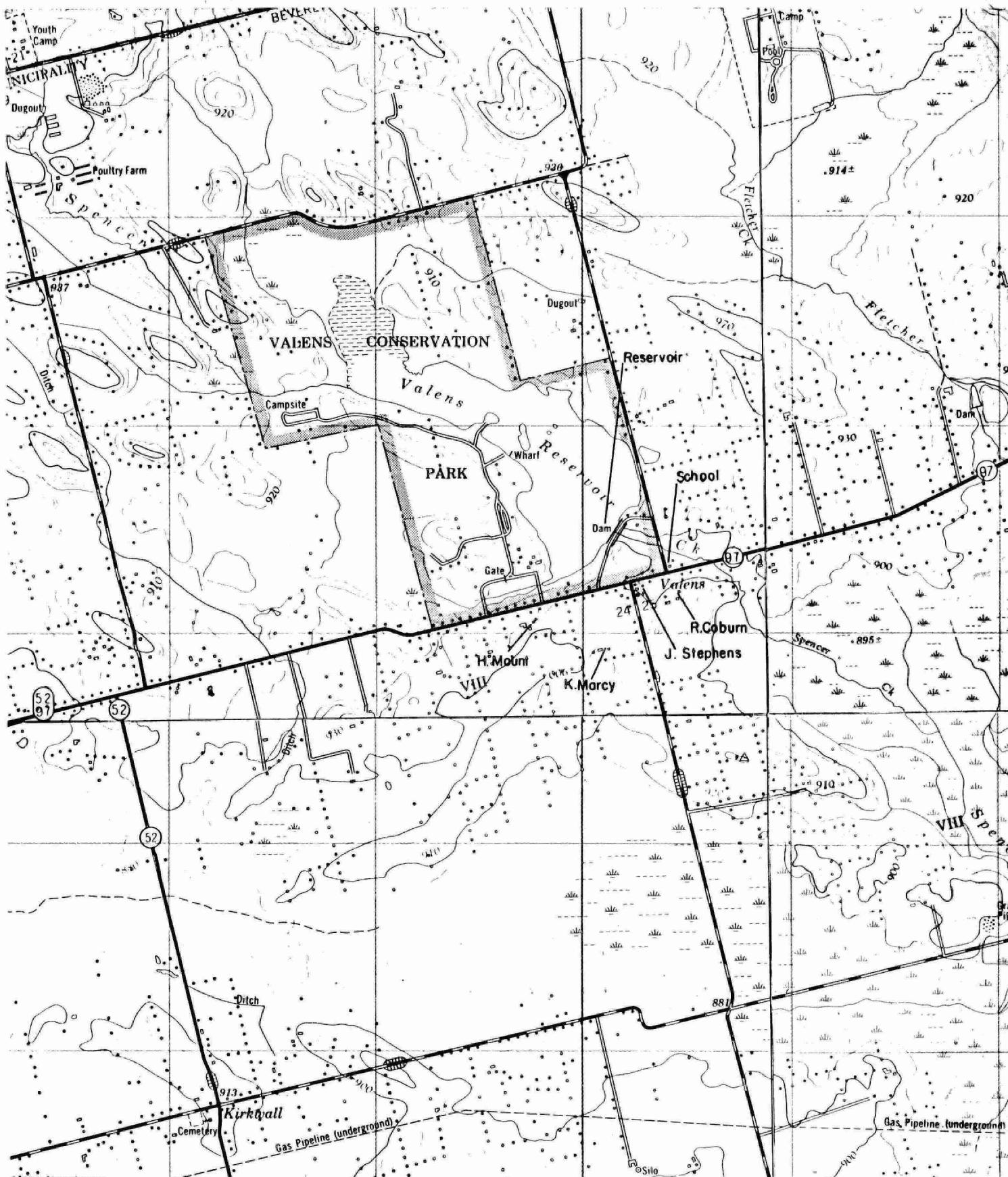


FIGURE 6
Elevation Levelling Survey Location Map

Scale
1:25,000

TABLE I
WELL WATER LEVEL SURVEY

Well Number	Well Owner	Date Constructed	Static Level at Date Const.	May 12, 1977	June 3/77	June 8/77	June 13, 1977	Static Level Change(ft)
1048	F. Spencer	April 1964	52 ft	38.91 ft			34.70 ft	13.09-17.30
999	J. Stephens	March 1966	Flowing Intermittently	Vent Installed Above Land Surface Inaccessible for Measurement				
1047	N. Law	October 1963	18 ft		12.21 ft		11.30 ft	5.79-6.7
	S. Cardullo			Dug Well(no rec) 5 ft			Dug Well(no rec) 5.48 ft	
1049	S. Cardullo	October 1964	10 ft		Inaccessible			
1043	W. Nickesch	October 1963	18 ft	Inaccessible				
1042	G. Monther	Feb. 1963	18 ft			8.92 ft	9.84 ft	9.08-8.16
1041	E. Davidson	Feb. 1966	8 ft	Inaccessible				
1040	J. Holtzhauer	October 1963	40 ft	30.84 ft			32.73 ft	9.16-6.43
7468	H. Dupuy	Feb. 1970	40 ft		40.16			.16
998	Boy Scout Camp	Sept. 1965	8 ft			7.15 ft		.85
997	J. Jennings	Nov. 1954	28 ft	Inaccessible				
996	B. McGeachy	August 1964	20 ft	15.09 ft				4.91
994	C. Roth	July 1960	15 ft			14.31 ft	14.46 ft	.69-.54
991	J. H. Hassell	Sept. 1961	20 ft	Inaccessible				

Well Number	Well Owner	Date Constructed	Static Level at Date Const.	May 12, 1977	June 3/77	June 8/77	June 13, 1977	Static Level Change
1044	H.R.C.A.	October 1965	11 ft			8.86 ft	Inaccessible	2.14
1000	W. Copp	Dec. 1961	27 ft	Inaccessible				
7988	R. Coburn	Nov. 1971	5 ft		Flowing			5 ft
	K. Marcy	October 1949	27 ft			16.40 ft		10.6-10.57
	H. J. Mount	NA	8 to 10 ft	Flowing				
	J. Mount	NA	NA					
	Valens School	NA	NA	Flowing	Flowing	Flowing	Flowing	L7

TABLE II
ELEVATION MEASUREMENTS

<u>Location</u>	<u>Elevation Above M.S.L.</u>	<u>Elevation Differential + or - Reservoir Water Level</u>
Reservoir Water Level	902.6 ft During Following Elevation Measurements	
Old School Well Top of Casing	894.6 ft	8.0 ft (flowing) Bedrock Aquifer
Coburn Dug Well Water Level	893.2 ft	9.4 ft Overburden Aquifer
Coburn Drilled Well Well Head	900.6 ft	2.0 ft (flowing) Bedrock Aquifer
Marcy Spring	898.4 ft	4.2 ft (flowing) Field Spring
Marcy Standing Water	895.9 ft	6.7 ft - Field Ditch
H. J. Mount Abandoned Dug Well Water Level	897.3	5.3 ft (flowing) Overburden Aquifer
Stephens Drilled Well Vent Outlet	899.0 ft	3.6 ft (flowing int.) Bedrock Aquifer

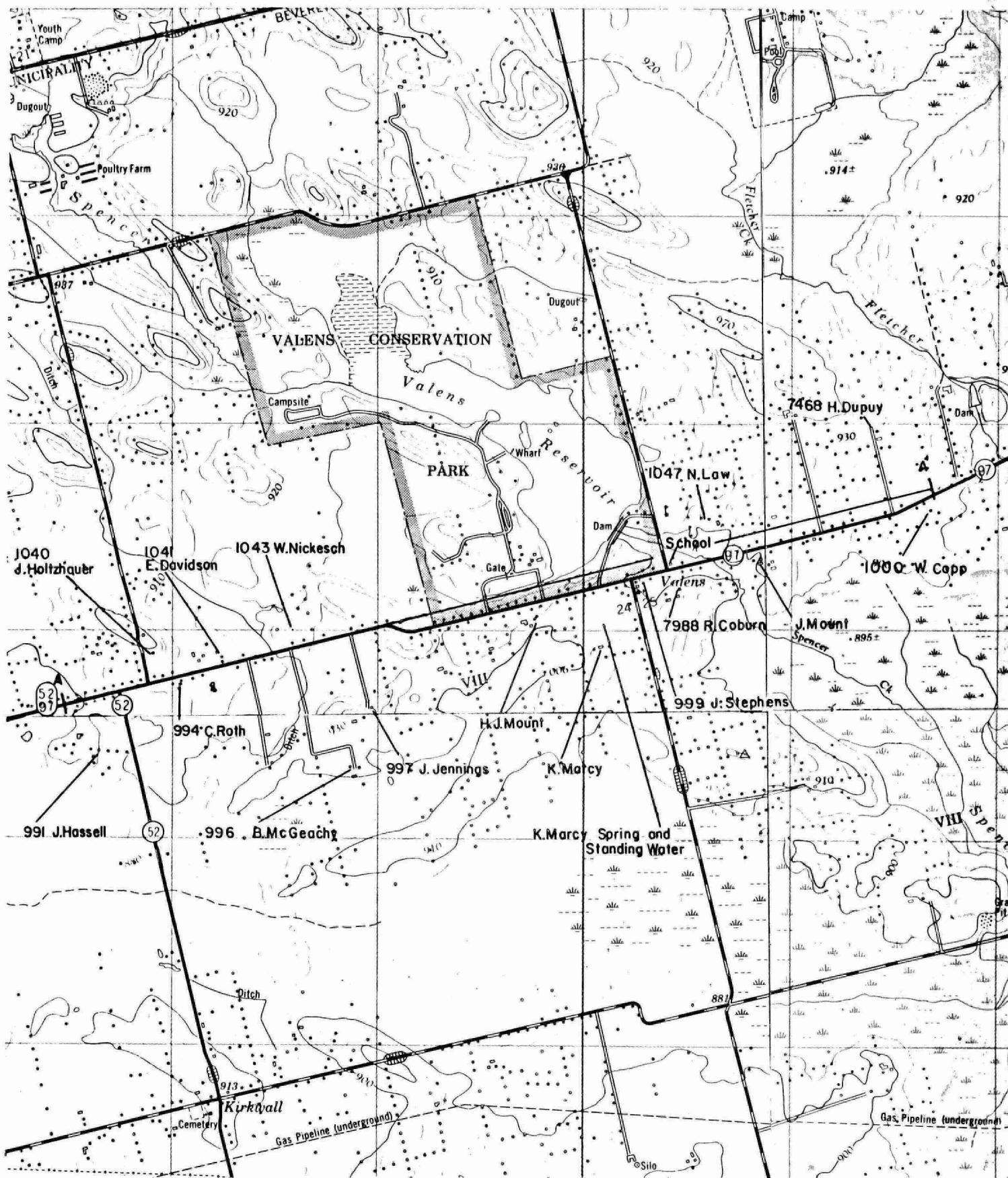


FIGURE 7
Hydrogeologic Cross-Section A-A' Location Map
Scale
1:25000

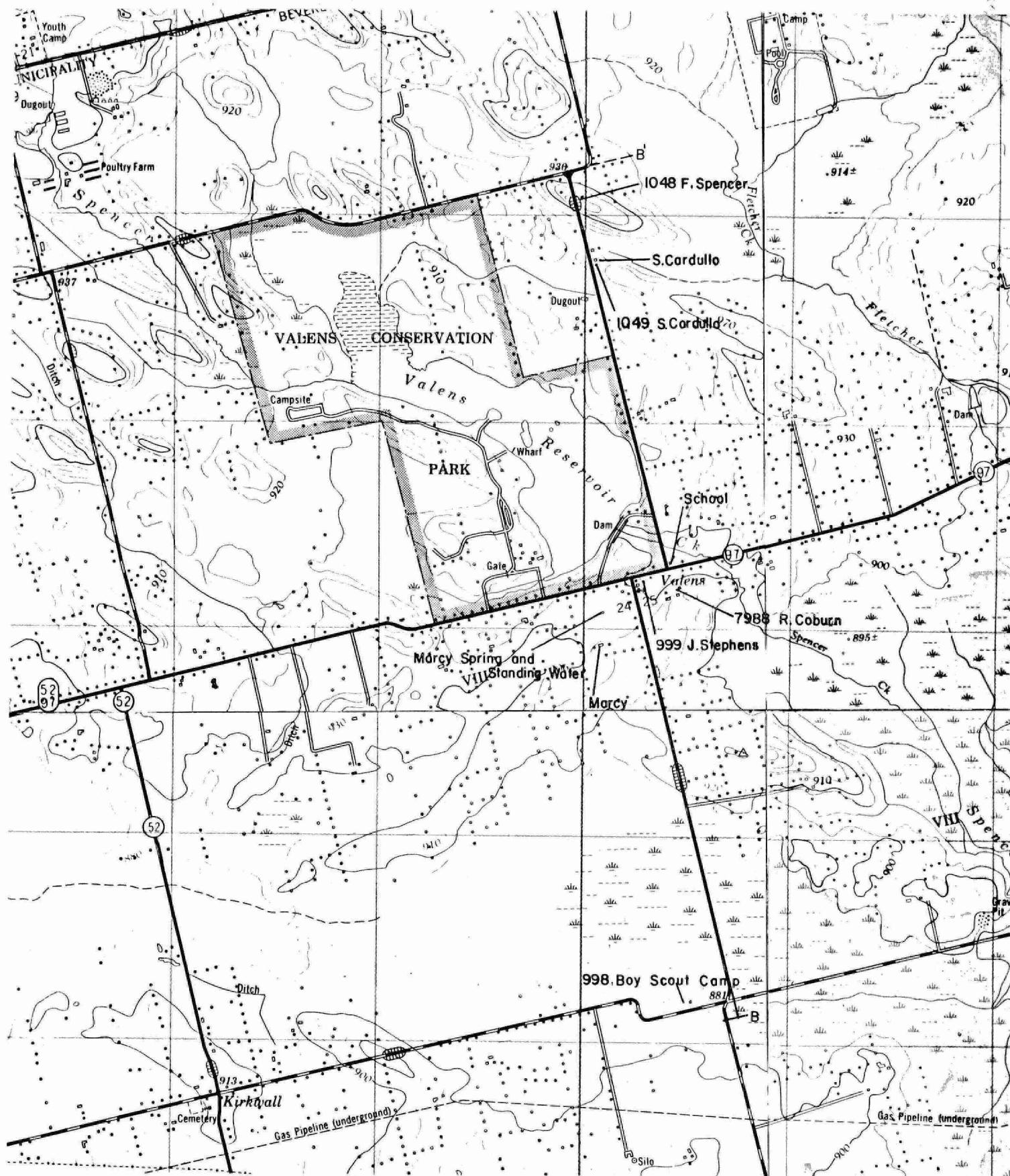


FIGURE 8
Hydrogeologic Cross-Section B-B Location Map

Scale
1:25,000

John Coates of the H.R.C.A. provided our office with the elevation of 901.0 feet for the spillway on the upstream side of the dam. The elevations measured are summarized in Table II.

CONCLUSIONS:

The physiographic and hydrogeologic characteristics of the Valens area have been outlined. In addition, the presence of an abandoned, unplugged well under water in the reservoir could be of some importance in contributing to the reservoir's effect. It would appear that the bedrock outcrop, prior to the impoundment of water, was a region of ground water discharge. However, it can now be a source of recharge. Since the reservoir is situated on the exposed bedrock, hydraulic connection between the reservoir and the bedrock aquifer, via fractures and solution channels, has been realized. The presence of the unplugged well could enhance the connection to the aquifer and also provides a direct transfer of pressure head from the reservoir to the bedrock ground water flow system. The increased pressure is evidenced by the perennially flowing well at the old schoolhouse, which since water impoundment, has experienced the increased head. The Coburn and Stephens wells, which probably flow with less vigor due to elevation or increased friction and aquifer head losses, are further examples of the impact on the bedrock ground water flow system.

Another consideration with regard to the bedrock aquifer, and keeping in mind the direct connection between the reservoir and aquifer, is the potential water transfer. The possibility exists for affecting the quality of water in the bedrock aquifer, should the water quality in the reservoir change. The reservoir water quality would thus be directly related to the bedrock aquifer water quality.

It has been noted from the surficial geology map (Figure 2) that the Marcy, as well as the Law/Braden farms are located on the southern portion of the Moffat Moraine. Considering the physiographic location, the Valens area is situated in proximity to the Lake Erie/Lake Ontario Drainage Basin divide, (Figure 3). It appears from the topography and regional physiography, that prior to water impoundment, the Marcy wetland likely drained toward Spencer Creek. However it now seems that the ground water drainage gradient has been reversed since the impoundment of water by the dam, thus resulting in ground water flow from the reservoir, toward the Marcy and Mount farms. This causes perennial wet land in Mr. Marcy's case and the flowing well in the case of Mr. Mount (Figure 9).

DISCUSSION:

This water table condition would be localized to farms in the immediate Valens area due to the regional geology which generally governs the ground water hydrology. The Marcy farm is known to have had wetland until late spring, prior to the dam. However, their concern is that this wetland condition has become greatly enlarged and irreversible since the reservoir's contribution to the water table of the area.

In essence, the reservoir has influenced the bedrock hydrology as evidenced by the flowing Coburn, old school, and Stephen's wells which intercept water from the bedrock aquifer, and also the water table hydrology as evidenced by the Marcy, Law/Braden wetlands and the H. J. Mount flowing well.

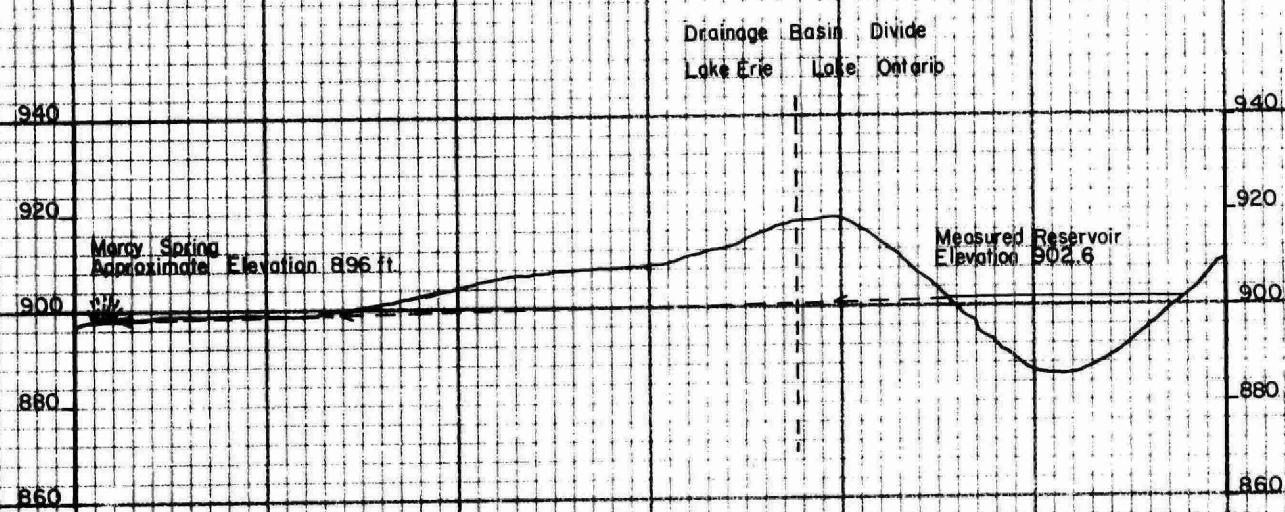
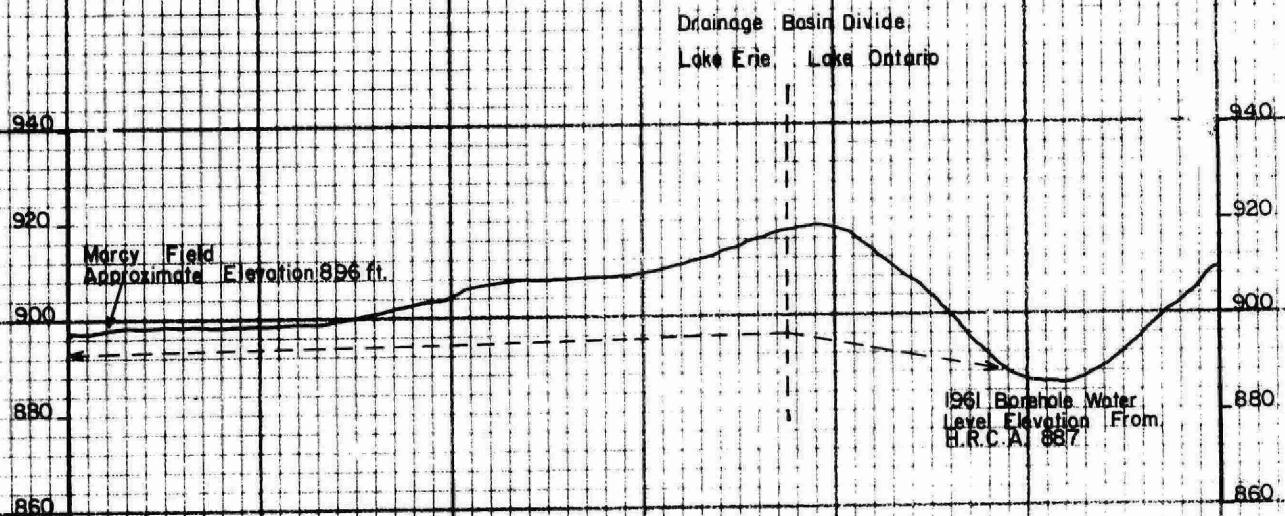


FIGURE 9

Simplified Graphic Simulations Of Suspected Water Table Ground Water Flow Systems Prior To And After Reservoir Construction

Scale

Horizontal: 1 Inch = 250 Feet

Vertical: 1 Inch = 40 Feet

RECOMMENDATION:

It is recommended that a copy of this report be provided to Mr. K. Marcy and the Hamilton Region Conservation Authority as well as other interested parties such as the Ministry of Agriculture and Food.

REFERENCES

Irwin, R. W., 1976, Marcy and Coburn Properties, Valens

Department of Energy and Resources Management, 1969,
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Table Survey.

Karrow, P. F., 1961, Pleistocene Geology of the Galt
Map Area, Geological Circular No. 9, Ontario
Department of Mines.

Ontario Ministry of the Environment, Water Resources
Map 3002-2, Drainage Basins in Southern Ontario.

Hamilton Region Conservation Authority, 1961, Plan of
Valens Reservoir, Plan of Valens Dam, R. K. Kilborn
and Associates Limited, Associated Geotechnical
Services Limited.

APPENDIX

SUMMARY OF WATER WELL RECORDS

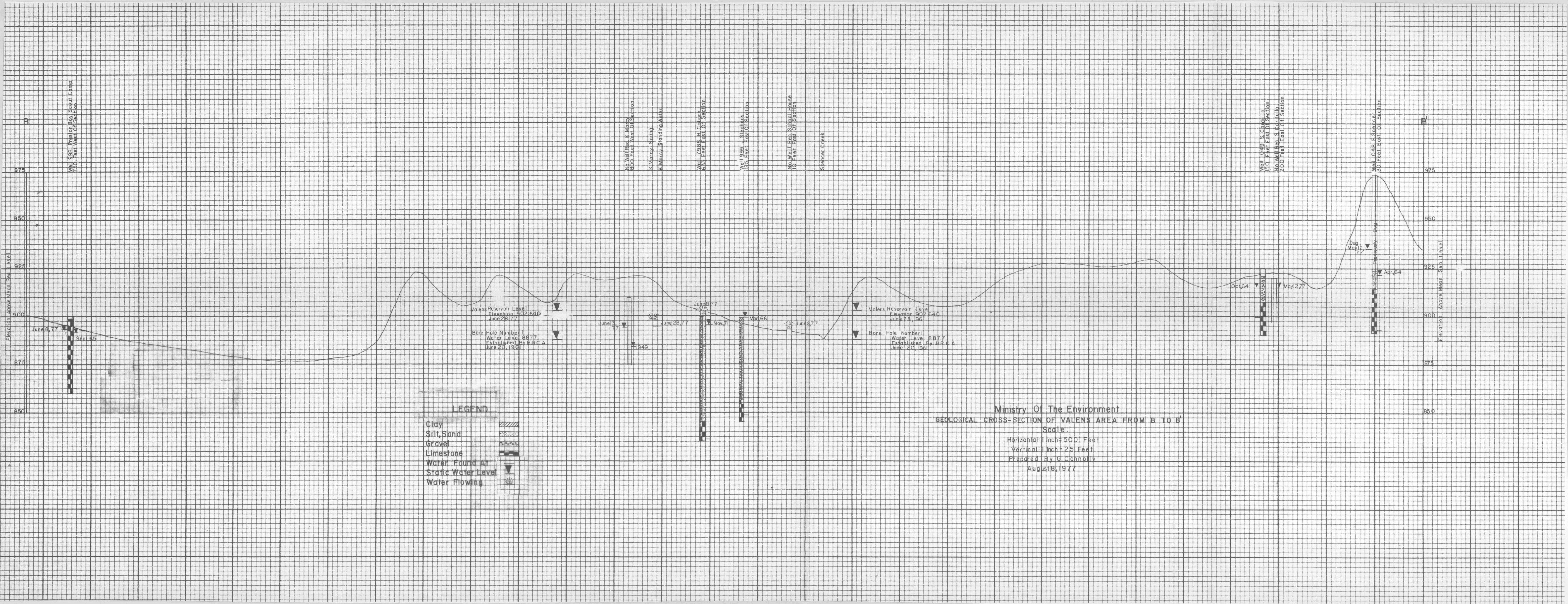
SUMMARY OF WATER WELL RECORDS

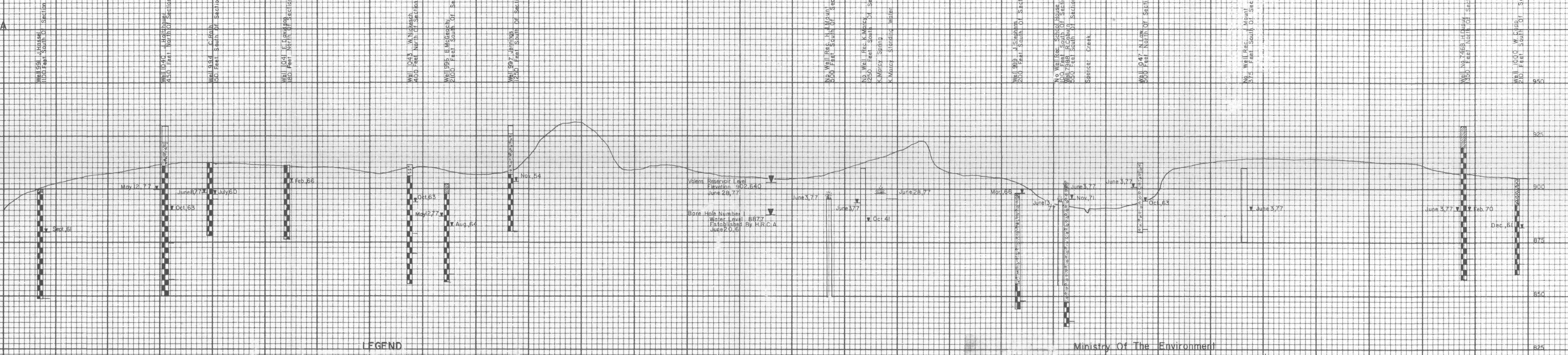
REGIONAL MUNICIPALITY: Hamilton-Wentworth TOWNSHIP: West Flamborough (Formerly Beverly) COMPILED: August 2, 1977 By G. Connolly

Well No.	Location			Elev. (ft)	Well Depth	Casing Record			Static Level	Pumping Test			Geologic Log
	Con	Lot	Date Drilled			Inside Dia.	Casing Length	Pumping Rate gpm		Hrs	Well Type*	Geologic Log	
991	8	18	Sept/61	J. Hassel	900	51	4 in	7 ft	20	10	1	B	Clay 0-1 ft Grey Limestone 1-51 ft
994	8	19	July/60	C. Roth	912	33.5	4 in	7 ft	15	10	1	B	Shale 0-7 ft Grey Limestone 7-33.5 ft
996	8	20	Aug/64	B. McGeachy	902	46	6.25in	7 ft	20	15	1	B	Brown Clay 0-5 ft Limestone 5-46 ft
997	8	21	Nov/54	J. Jennings	927	50	5 in	23 ft	28	12	.5	B	Soil 0-3 ft Brown Clay Some Stone 3-23 ft Grey Limestone 23-50 ft
998	8	24	Sept/65	Preston Boy Scout Camp	900	40	5 in	4 ft	8	15	4	B	Top Soil 0-1 ft Grey Limestone 1-40 ft
999	8	25	Mar/66	J. Stephens	899	54	6.25in	44 ft	Flowing	15	3	B	Brown Clay 0-2 ft Sand Clay 2-43 ft White Limestone 43-54 ft
1000	8	28	Dec/61	W. Copp	905	45	6.25in	13 ft	27	8	2	B	Brown Clay and Gravel 0-12 ft Limestone 12-45 ft
1040	9	19	Oct/63	J. Holtzhauer	927	80	6.25in	19 ft	40	10	.5	B	Stoney Clay 0-19 ft Bedrock 19-80 ft
1041	9	19	Feb/66	E. Davidson	911	35	6.25in	12 ft	8	20	1	B	Stone and Broken Rock 0-3 ft Limestone 3-35 ft

Well No.	Location			Date Drilled	Owner	Elev. (ft)	Well Depth	Casing Record			Static Level	Pumping Test			Geologic Log
	Con	Lot	Date Drilled					Inside Dia.	Casing Length	Pumping Rate gpm		Hrs	Well Type		
1042	9	20	Feb/63	G. Monther	925	75	6.25in	23 ft	18	20	.5	B	Clay Some Gravel 0-23 ft Limestone 23-75 ft		
1043	9	20	Oct/63	W. Nickesch	911	55.6	6.25in	8.5ft	18	5	1	B	Broken Limestone and Silt 0-5 ft Grey Limestone 5-55.6 ft		
1044	9	22	Oct/65	H.R.C.A.	900	60	6.25in	7 ft	11	20	.5	B	Top Soil 0-1 ft Broken Shale Rock 1-3 ft Limestone 3-60 ft		
1047	9	25	Oct/63	N. Law	912	33	6.25in	36 ft	18	15	1	O	Hard Pan 0-4 ft Boulder Sand and Gravel 4-33 ft		
1048	9	25	Apr/64	F. Spencer	973	83	6.25in	40 ft	52	15	1	B	Dug 0-50 ft Silt 50-60 ft Limestone 60-83 ft		
1049	9	25	Oct/64	S. Cardullo	925	30	6.25in	20 ft	10	20	6	B	Soil 0-4 ft Gravel 4-18 ft Limestone 8-30 ft		
7468	9	27	Feb/70	M. Dupuy	927	72	6 in	19 ft	40	25	1	B	Brown-grey Clay , Stone 0-10 ft Grey Limestone 10-72 ft		
7988	8	25	Nov/71	R. Coburn	900	65	6 in	57 ft	5	30	2.5	B	Brown Sand Gravel 0-54 ft White Limestone 54-60 ft		

* B - Drilled Bedrock O - Drilled Overburden





LEGEND

Cidy	Broker Limestone, Sand
Tidy, Hardpan	██████
Silt, Sand
Gravel	○○○○
Limestone	■■■■

Water Found At

Static Water Level

Water Flowing

Ministry Of The Environment

GEOLOGICAL CROSS-SECTION OF VALENS AREA FROM A TO A'

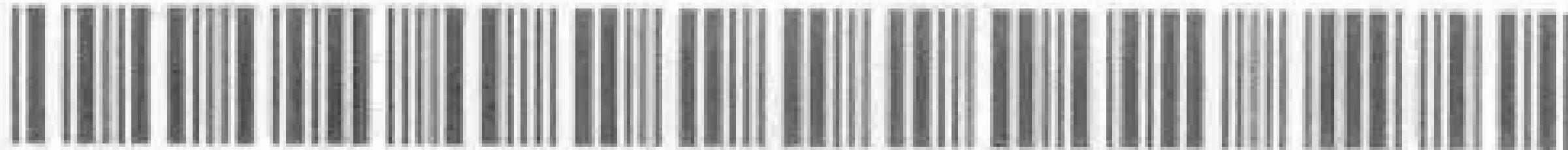
Scale:

Horizontal: 1 Inch = 500 Feet

Vertical: 1 Inch = 500 Feet

Prepared By G Connolly

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